WHAT IS CLAIMED IS:

1.   A method for determining a phenotype of an organism, comprising:

providing a table of metabolic reactions known to take place in the organism, wherein the products of at least one metabolic reaction are linked to the reactants of another metabolic reaction;

determining a candidate metabolic gene on the organism's genome;

providing the nucleotide sequence of the open reading frame of the candidate metabolic gene;

assigning a function to the candidate metabolic gene based on its nucleotide or amino acid homology to other, known metabolic genes;

determining the metabolic reaction of the candidate metabolic gene based on the assigned function of the candidate metabolic gene;

adding the metabolic reaction of the candidate metabolic gene to the table of metabolic reactions; and

determining a phenotype of the organism by performing a mathematical analysis of the table of metabolic reactions.

2.   The method of Claim 1, comprising identifying a metabolic gene that when removed from the table of metabolic reactions would result in a suboptimal phenotype.

3.   The method of Claim 1, comprising identifying a metabolic gene that when removed from the table of metabolic reactions would result in a lethal phenotype.

4.   The method of Claim 1, comprising reducing the flux of the metabolic reaction of the candidate metabolic gene to determine whether the reduction would result in a lethal phenotype.

5.   The method of Claim 1, wherein the phenotype is selected from the group consisting of: growth, increased metabolite secretion and increased protein secretion.

6.   The method of Claim 1, comprising determining the minimal media composition required to sustain growth of the organism.

7.   The method of Claim 1, comprising determining the optimal requirements for maximizing a growth phenotype of the organism.

8.   The method of Claim 1, comprising determining the genes in the organism necessary to sustain highest level of growth under a particular environmental condition.

9.   The method of Claim 1, wherein the mathematical analysis is an optimization analysis.

10.   The method of Claim 9, wherein the optimization analysis is a Flux Balance Analysis using linear programming methods.

11.   The method of Claim 1, comprising determining whether an input to the table of metabolic reactions results in a phenotype of increased output of a metabolic product.

12.   A computer system comprising a memory having instructions that when executed perform the steps of:

providing a table of metabolic reactions known to take place in the organism, wherein the products of at least one metabolic reaction are linked to the reactants of another metabolic reaction;

determining a candidate metabolic gene on the organism's genome;

providing the nucleotide sequence of the open reading frame of the candidate metabolic gene;

assigning a function to the candidate metabolic gene based on its nucleotide or amino acid homology to other, known metabolic genes;

determining the metabolic reaction of the candidate metabolic gene based on the assigned function of the candidate metabolic gene;

adding the metabolic reaction of the candidate metabolic gene to the table of metabolic reactions; and

determining a phenotype of the organism by performing a mathematical analysis of the table of metabolic reactions.

13.   The computer system of Claim 12, wherein said memory is selected from the group consisting of: a hard disk, optical memory, Random Access Memory, Read Only Memory and Flash Memory.

14.   The computer system of Claim 12, comprising instructions that when executed perform a method of identifying a metabolic gene that when removed from the table of metabolic reactions would result in a suboptimal phenotype.

15.   The computer system of Claim 12, comprising instructions that when executed perform a method of identifying a metabolic gene that when removed from the table of metabolic reactions would result in a lethal phenotype.

16.   The computer system of Claim 15, comprising instructions that when executed perform a method of reducing the flux of the metabolic reaction of the candidate metabolic gene to determine whether the reduction would result in a lethal phenotype..

17.   The computer system of Claim 12, wherein the phenotype is selected from the group consisting of: growth, increased metabolite secretion and increased protein secretion.

18.   The computer system of Claim 12, comprising instructions that when executed perform a method of determining the minimal media composition required to sustain growth of the organism.

19.   The computer system of Claim 12, comprising instructions that when executed perform a method of determining the optimal requirements for maximizing a growth phenotype of the organism.

20.   The computer system of Claim 12, comprising instructions that when executed perform a method of determining the genes in the organism necessary to sustain highest level of growth under a particular environmental condition.

21.   The computer system of Claim 12, wherein the mathematical analysis is an optimization analysis.

22.   The computer system of Claim 21, wherein the optimization analysis is a Flux Balance Analysis using linear programming methods.

23.   The computer system of Claim 12, comprising instructions that when executed perform a method or determining whether an input to the table of metabolic reactions results in a phenotype of increased output of a metabolic product.